Missouri Botanical Garden

North American Center for the Study of African Plants

Introduction: The Missouri Botanical Garden was recognized as the North American Center for the Study of African Plants in 1970 in response to a call from international botanists for an institution in the New World to join European and African colleagues in studying the continent's rich flora. Since then, the Garden has developed a broad, multi-faceted, and highly influential African program that has contributed to science, conservation, and local capacity building. In collaboration with local botanists and in-country institutions, much of our effort has focused on biodiversity-rich areas, especially Central Africa (primarily Gabon, but also Cameroon, Equatorial Guinea, and São Tomé and Príncipe), East Africa (Tanzania, as well as Kenya and Uganda), and South Africa, but the Garden has also been involved in 22 other countries.

Activities: Field work in West and Central Africa, initiated in 1981, has generated more than 50,000 collections, many from previously unexplored areas. Our team based in Gabon has conducted more than 60 studies at botanically rich sites, increasing the number of specimens collected there by 40 percent, while also discovering new and threatened species, and identifying conservation priorities. Several major projects have also been carried out in West Africa (Guinea Conakry and Liberia), whose distinctive flora is highly threatened. In East Africa, field work by Garden staff and associates began in 1984, generating more than 71,000 collections for taxonomic studies, biodiversity surveys, conservation assessments, and research on climate change projections. Many of our local collaborators were initially trained by Garden staff and continue to work with us today, greatly increasing our capacity and effectiveness.

Conserving Threatened African Orchids

Orchid conservation represents a significant challenge in tropical Africa, where forests are facing ever-increasing pressure from agriculture, mining, and logging activities. African forests contain many epiphytes—plants that grow on the trunks and branches of trees—most of which are impossible to identify when encountered in the field because they lack flowers. However, accurate identification is essential for taxonomic research and for determining which species are threatened and require conservation action. To overcome this challenge, Garden botanist Tariq Stévart developed a novel shadehouse cultivation system in São Tomé in 1997, which has now been extended to several countries across Africa and beyond. Living plants are grown in carefully controlled conditions and when they flower, identifiable material is collected and photos are taken. Nearly 25,000 living orchids have been grown in the Missouri Botanical Garden managed shadehouse network, representing some 500 species and leading to the discovery of at least 50 previously unknown species that are new to science. In addition to greatly facilitating orchid inventory, research, and identification, shadehouses also contribute to conservation by protecting plants in safe conditions and producing material for seed banking, while also offering valuable training opportunities for young botanists, thereby increasing in-country capacity.

Fig. 1 (top, left) The Yaoundé shadehouse in Cameroon, with more than 6,500 living specimens, is the largest collection of living orchids in Africa. Established by the Plant Systematics and Ecology Laboratory, it is managed in collaboration with the Missouri Botanical Garden, the French *Institut de Recherche pour le Développement*, and the *Université Libre de Bruxelles* in Belgium. The facility is maintained by local students, who use it to conduct research projects, and has generated more than 7,000 specimens, significantly contributing to our knowledge of the 250 orchid species cultivated there.

Fig. 2 (top, right) Since 2015, the Yaoundé orchid collection has provided material for the first orchid seed bank in tropical Africa, with support from the National Geographic Society's Conservation Trust program and the American Orchid Society. This project aims to document Central African orchids and bank viable seeds, focusing on the most threatened species.

Fig. 3 (bottom, right) *Ancistrochilus rothschildianus*, one of the most beautiful yet rare orchids, was collected by a team of Missouri Botanical Garden botanists in a highly threatened area near the Mont de Cristal National Park in Gabon. Living specimens were gathered in the field and grown in the shadehouse in Libreville, ensuring that this species will be conserved.

Lower Ogooué Biodiversity Survey

A comprehensive biodiversity study of the Lower Ogooué was led by the Garden starting in 2012. This extensive wetland area, covering 862,700 hectares (2.13 million acres), is the third largest and best preserved river delta in Africa. The area's global importance was recognized in 2009 when it was designated as a Ramsar site. However, because very little was known of its flora and fauna, the Missouri Botanical Garden was asked to conduct a multidisciplinary study to characterize the biodiversity of the Lower Ogooué and to identify conservation priorities. Garden botanists conducted 10 field trips and made more than 5,200 collections (5 percent of the total number of specimens collected in Gabon), documenting the presence of nearly 1,700 species, about 200 of which are threatened and 33 are new to science. Most of the area comprises large stands of *Raphia* forest, floating papyrus, and *Persicaria* prairies, but some habitats such as littoral forests or coastal savannahs on white sands are very limited and harbor populations of rare species. The study provides a baseline for consultation with stakeholders, including government authorities and local communities, to improve management of the site and identify priorities for future protected areas.

Fig. 1 (top) A delta within the delta. The complex channels of water running through the Ramsar site create a unique landscape composed by lakes, rivers of all sizes, marshes, and seasonally flooded vegetation.

Fig. 2 (middle) The 200-page hardcover book *Le delta de l'Ogooué*, prepared by Jean-Pierre Vande weghe and Garden staff member Tariq Stévart, and edited by the Gabon National Parks Agency and the *Direction Générale de l'Environnement*, presents the results of the 5-year study of this vast Ramsar site. It features information on the plants and vegetation, as well as surveys of the area's birds, mammals, marine wildlife, and reptiles, and represents the most complete description of the biodiversity of the Lower Ogooué to date.

Fig. 3 (right) Seasonally inundated forest is a rare habitat and a major component of the Lower Ogooué landscape, harboring a unique flora.

Exploring Plant Diversity

Botanical exploration conducted by the Garden in Africa over the last 35 years has resulted in more than 170,000 collections representing over 25,000 species, more than 5 percent of which have been described as species new to science. The Garden's exploration efforts reflect our regional programs: a total of 120,000 collections were made in just four countries, Cameroon, Gabon, South Africa, and Tanzania, together generating valuable material of about 19,000 species, often accompanied by high-quality photos. In the past decade, new initiatives in West Africa have added nearly 7,000 collections from Guinea Conakry and Liberia, and field work in São Tomé and Príncipe has resulted in this tiny island nation having the highest collection density per unit area in Africa. The Garden's work has focused on many regions and habitats, often emphasizing areas that were poorly known or totally unexplored. Results from our exploration are disseminated to scientists and other stakeholders as well as the general public through both print and dedicated online resources. Comprehensive information on all plant collections, along with maps and photos, are available in the online Tropicos® database, the world's largest and most complete source of botanical information.

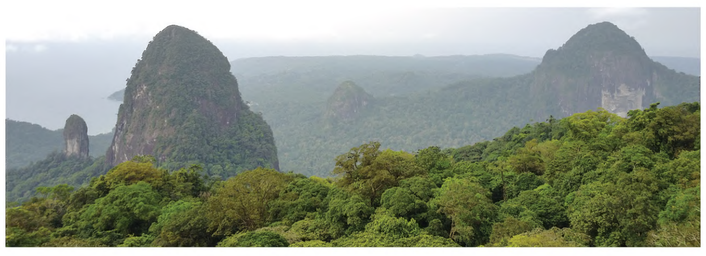

Fig. 1 (top) In March 1998, material of a distinctive screw pine (*Pandanus*) was collected on the island of Príncipe that differed from the species occurring on nearby São Tomé island. Three young plants were transplanted to the Botanical Garden of Bom Sucesso on São Tomé, and flowered in 2008, but all were male trees and so the fruits, needed for reliable identification, remained unknown. Fruits were finally collected in 2018 on Pico Príncipe, the island's highest peak; they were smaller than those of *Pandanus thomensis* from São Tomé, confirming yet another new species from Príncipe.

Fig. 2 (bottom) Two expeditions were conducted on Príncipe with support from the Global Trees Campaign Fund, in collaboration with Fauna and Flora International, Fundação Príncipe Trust, and the University of Coimbra, in support of conservation work on rare tree species and threatened habitats. The team recorded 45 new records for the island, including eight species new to science, identified the most threatened species, and developed a new classification of forest habitats.

Conservation Assessments

In order to conserve species, it is essential to know which ones are most at risk of extinction. The Global Strategy for Plant Conservation calls for an assessment of the conservation status of all known plant species by 2020. In Africa, we have contributed to this effort in many ways. The Missouri Botanical Garden participated in the compilation of records for nearly 20,000 tropical African species and conducted preliminary assessments, showing that about 35 percent are likely threatened. Garden botanists helped establish the East Africa Plants Red List Authority in 2006, which has met 18 times; 50 participants from 10 countries have assessed more than 2,500 taxa to date, comprising nearly 20 percent of the region's total flora. Almost 60 percent of these species were found to be threatened, and this information is now being used to prioritize conservation actions. Garden staff also helped create the Central Africa Plant Red List Authority, which has held several workshops, validating the status of hundreds of species and training local botanists in Red List methods. In Gabon, the Missouri Botanical Garden is also leading efforts to define conservation priorities by identifying species that require conservation action, including legal protection, and rendering this information available to all stakeholders using a dedicated website. All these efforts leverage the vast information contained in the Missouri Botanical Garden's Tropicos® database along with our staff's expertise and knowledge to inform conservation efforts throughout Africa.

Figs. 1 and 2 (top, and bottom, left) *Brachystelma letestui* (Apocynaceae-Asclepioideae) was previously only known from a few specimens collected between 1894 and 1912 on the western coast of Gabon, near the country's second largest city, Port-Gentil. After intensive field exploration in the rare habitat of this species—coastal savannah on white sand—additional populations were recorded, and an additional historical collection from coastal Congo was located. This species, which is threatened by oil extraction and urban expansion, was assessed as Endangered.

Fig. 3 (bottom, right) Participants in the seventh workshop of the East Africa Red List Authority in Nairobi, Kenya, April 2013.

Conservation of the African Flora

The Garden's conservation work in Africa is based on using diverse approaches to document the region's plant diversity. Our work aims to identify species, habitats, and areas important for plant conservation. This information is then used to support national land use planning, protected areas management, sustainable forestry, and responsible agricultural and industrial projects such as sustainable palm plantations and mining projects designed to have a net positive impact on biodiversity. The Missouri Botanical Garden works with governments, NGOs, and other stakeholders to identify priorities for biodiversity management and conservation. The Garden also assists private companies committed to sustainable economic development by identifying and mitigating impacts and supporting conservation efforts such as the creation of new protected areas and the development of *ex situ* conservation measures to grow threatened species. For example, in Gabon we have identified key areas for protection as biodiversity sanctuaries within logging concessions, and in Tanzania dozens of botanical expeditions have been conducted in biodiversity hotspots with exceptional floristic diversity.

Fig. 1 (left) In Gabon, the *Forêt Classée de la Mondah*, northwest of the capital city, Libreville, was long suspected to harbor endemic species, but has regularly been degraded over the years, losing 40 percent of its area over the past seven decades. Targeted field work by the Missouri Botanical Garden and collaborators located populations of locally endemic species, many of which were brought into cultivation, and all of which are threatened by agriculture, sand extraction, the collection of medicinal plants, ceremonial usage, and urban expansion. *Psychotria bracteosa* (a member of the coffee family, Rubiaceae), one of the 23 local endemics whose conservation status was evaluated, was determined to be Endangered. The Missouri Botanical Garden proposed new limits for the Mondah protected area to include irreplaceable habitat of these threatened species.

Fig. 2 (right) In West Africa, the Garden undertook a major inventory of the Nimba Mountains in Guinea Conakry. This 5,250-ft. mountain range, which extends into Ivory Coast and Liberia and contains a UNESCO World Heritage site, is one of the most diverse places in West Africa. The Missouri Botanical Garden has collected 1,700 species there since 2012. The resulting information has helped us identify which species are threatened and design conservation action plans.

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Science and Conservation at the Missouri Botanical Garden

With operations in over 35 countries around the globe, the Missouri Botanical Garden collaborates with local institutions wherever Garden botanists conduct research and field work, providing technical expertise, assistance with fundraising, and better communication with the worldwide scientific community.

The research division consists of 43 Ph.D. botanists assisted by 144 support staff and 22 graduate students. Studies concentrate on the plants of Meso- and South America, sub-Saharan Africa, Madagascar, China, and North America.

Individual Garden scientists are specialists in the plants of particular regions, in the systematics and evaluation of major plant families, and in the interactions between plants and people.

The Garden serves as the headquarters for several major collaborative publications, such as *Flora of North America* and *Flora Mesoamericana.*

For more information, visit
mobot.org/plantscience

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The iconic **African baobab** (*Adansonia digitata*) depicted from a rare book in the Missouri Botanical Garden Library.

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